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Amplitude changes in the electrophysiological response of retinal cells during simultaneous current stimulation.

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Abstract

Purpose : Ocular electrical stimulation exhibit potential for the treatment of neurodegenerative ocular diseases. However, the underlying mechanism in the retinal cells remains subject of research. Studies applying transcranial electrical stimulation show that direct current stimulation (DCS) over the visual cortex manipulates the amplitudes of visual evoked potentials. An anodal DCS leads to increased amplitudes

while a cathodal DCS decreased these amplitudes. We hypothesize that the retinal cells show similar reactions.

Methods : We stimulated 15 volunteers (8m, 7f, 23.5 ± 1.6 years, one eye) with a cathodal DCS of 500 µA (DC-stimulator MC, neuroConn GmbH, Ilmenau) for 10 minutes. For DCS we used six cup electrodes (diameter: 0.95 cm) placed around one eye . Before, during and after DCS we measured the electrophysiological answer of the retinal ganglion cells using a pattern-reversal stimulus (stimulus field: 1° individual checks, 16° total; reversals per second: 4; Michelson contrast: 99%; mean luminance: 186 cd/m^2). For recording, we used Ag/AgCl ring electrodes located at the lower eyelid and the earlobe. For statistical analysis the Friedman test for paired samples and a confidence interval analysis was performed.

Results : The characteristic amplitudes of the the electrophysiological answer (P50 and N95 component) as well as its peak-to-peak difference (PPD) were decreased during the stimulation. The visible trend was statistically not significant (Friedman test P50/N95/PPD: p = 0.527/0.574/0.297). Under consideration of specific volunteers (showed expected reduction of the N95 component, n = 9) we found a significant change of the N95 component for the difference between before and during DCS (confidence interval analysis, lower limit: -2.45 µV; upper limit: -0.38 µV; after Bonferroni correction α = 0.0143).

Conclusions : The performed study indicates a trend that a cathodal DCS decreasing electrophysiological activity in the retina.

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